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CIA/SC/RR 156

Dissemination Authorized  
Assistant Director  
Office of Current Intelligence

25 October 1956

[REDACTED]  
No. Pages - 40

Copy No. - 75

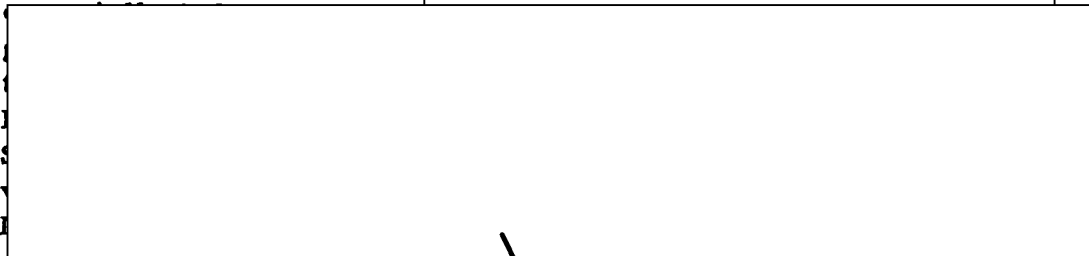
THE TIN INDUSTRY IN THE SINO-SOVIET BLOC



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FOREWORD

The main purpose of this report is to determine whether or not supplies of primary tin in the Sino-Soviet Bloc are adequate to meet demands. To achieve this purpose, estimates of the production of, the trade in, and the demands for primary tin have been developed. Inputs of materials and labor, operating costs, capital investments, and prices have not been considered.

Although the estimates given in this report contain relatively wide ranges of error, they are believed to be adequate for the purpose of the report. They should be used with caution, however, in establishing conclusions on matters other than those considered herein.

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CIA/SC/RR 156  
(ORR Project 24.867)

THE TIN INDUSTRY IN THE SINO-SOVIET BLOC\*

Summary

Both the domestic supply of and the demand for primary tin\*\* in the Sino-Soviet Bloc increased greatly from 1950 to 1955. In this 6-year period, production doubled, increasing from 13,000 to 26,000 metric tons,\*\*\* while in the same period the demand increased from about 16,000 to about 28,000 tons. Although these increases were great, the quantities involved were relatively small in comparison with production and consumption in the West. In 1955, for example, production in the West was 172,000 tons, and consumption in the countries of the North Atlantic Treaty Organization (NATO) alone was almost 118,000 tons. The demand for tin in the US in 1955, 60,000 tons, was about 3 times the estimated demand in the USSR. The relatively large consumption of tin in the production of tinplate in the West was a major reason for the wide difference between the consumption in the West and that in the Bloc.

The acquisition of Communist China by the Soviet Bloc significantly altered the domestic tin supply position of the Bloc. Long an important tin producer, China has resources estimated to be among the largest in the world. Furthermore, China is the lowest cost producer within the Sino-Soviet Bloc. From 1950 to 1955, Chinese Communist production of tin increased very rapidly; production in 1955 exceeded the pre-Communist peak production and

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\* The estimates and conclusions contained in this report represent the best judgment of ORR as of 1 August 1956.

\*\* Except where otherwise indicated, the term tin as used in this report refers to primary tin.

\*\*\* Tonnages are given in metric tons throughout this report.

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represented about 61 percent of the total for the Bloc. Although Chinese production has increased rapidly, it remains considerably below that of Malaya, Indonesia, and Bolivia. The size of the Chinese resources is such that, given sufficient time and investment, production probably could be increased greatly.

Although production of tin in the USSR increased during 1950-55, it was hampered by a shortage of economically exploitable tin ore resources, and the increase has been slower and more costly than that in Communist China. Soviet production of tin in 1955 is estimated to have represented about 37 percent of the total production of the Sino-Soviet Bloc. The remaining 2 percent was produced in East Germany in a high-cost processing of lean and complex ores.

Throughout the entire period from 1950 to 1955, imports of tin by the Sino-Soviet Bloc decreased, both in terms of percentage of total Bloc supply and in terms of actual tonnages. These imports, ranging from a maximum of 6,700 tons in 1951 to a minimum of 1,600 tons in 1954, were obtained largely from Southeast Asia, either directly or via the Netherlands and/or the UK. The decline in the importance of imports probably was a direct reflection of increasing production in Communist China.

In the Sino-Soviet Bloc, as elsewhere, rising levels of industrial production have increased the demand for tin. Although the development of some substitutes and alternative materials for some tin products has lowered the average annual increases in tin consumption in comparison with the average annual increases in industrial production, a statistical relationship between tin consumption and industrial production can be developed. This relationship is not affected materially by the recovery and use of secondary metal, because the supply of scrap available depends primarily on the level of industrial production and the use of tin products therein. Hence the recovery and use of secondary metal tends to remain a relatively constant percentage of total tin consumed in industrial

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production. Because of the almost complete absence of data reflecting directly the position of secondary metal within the Bloc, only the supply of and the demand for primary tin are considered.. Of the estimated 28,000 tons of tin consumed in the Bloc in 1955, about 72 percent was required by the USSR; Poland and Czechoslovakia consumed much of the remaining 28 percent. It is anticipated that the demand for tin in the Bloc will continue to increase along with future expansion of industrial production.

The USSR is known to have accumulated some stocks of tin, part of which were obtained under Lend-Lease during World War II. The magnitude of these stocks, suggested by the differences between the estimated supply of and demand for tin since the beginning of World War II, may be sufficient to meet demands at present levels for 10 months in the USSR or up to 7 months in the entire Sino-Soviet Bloc.

In spite of a rapid increase in production from 1950 to 1955, current production of tin in the Sino-Soviet Bloc is slightly below estimated demand. Furthermore, all of the producing areas are far from the major consuming areas; this is especially true of the largest producing area, southern China. The European Satellites depend almost entirely on imports for supplies. On the basis of tin ore reserves, the Bloc as a whole, however, is capable of becoming self-sufficient in tin and conceivably could export tin to the West.

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I. Introduction.

The main purpose of this report is to determine whether or not supplies of primary tin in the Sino-Soviet Bloc are adequate to meet demands. In the Bloc, as elsewhere, tin is an essential component of numerous industrial alloys, such as bronze, babbitt, and solder, which are widely used throughout industry. - Tin is also consumed in the Bloc in the form of tinplate for the packaging of various consumer goods, especially food products, but because the economies of the Bloc countries have been deliberately oriented toward developing industrial production and military potential, the proportion of tin consumed in industrial alloys in the Bloc is much higher than in the US.

Over the past 20 years, all of the major tin-consuming countries of the world, including the USSR, have been engaged in an intensive research program to reduce dependence on tin products. The major reasons for this program have been shortages of tin, which developed during World War II, and the continued military vulnerability of the major world sources. Although some successes have been achieved in the development of substitutes, tin alloys have continued to be essential for many industrial applications. Furthermore, tinplate continues to be the most economical material available for the packaging of food products.

To achieve the purpose of this report, the following steps have been taken: (a) development of estimates of tin production and consideration of production potential within the Sino-Soviet Bloc; (b) development of estimates of imports and an evaluation of their relative importance; and (c) development of the probable demands for tin in the various countries of the Bloc on the basis of the relationship of that demand to trends of industrial development.

As previously noted, this report is concerned with primary tin only. Although the supply and use of secondary tin is not considered directly in the development of the various estimates

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given, the absence of such data does not affect significantly the validity of the estimates made for primary tin. Primary tin is consumed almost entirely in two forms, as tinplate and as industrial alloys. As tinplate, secondary tin is not consumed in appreciable quantities, nor is there a significant recovery of tin from tinplate scrap. The quantities of secondary tin recovered and used in industrial alloys is determined largely by the quantity of scrap available, which, in turn, is determined by the level of industrial production. The supply and use of secondary tin therefore tends to remain a relatively constant percentage of the total tin consumed in industrial production.

Because of the fragmentary nature of the data relating to the supply-demand balance for tin in the Sino-Soviet Bloc, the methodology used to obtain the various estimates required is of prime importance. For details of the methodology used, see Appendix B.

## II. Production.

From 1950 to 1955 the production of tin in the Sino-Soviet Bloc increased from an estimated 13,000 tons to an estimated 26,000 tons, from about 8 percent of the world's total production in 1950 to about 14 percent in 1955. Within the Bloc, Communist China, the most important producer of tin, accounted for almost 61 percent of Bloc production in 1955. The USSR produced about 37 percent in 1955, and East Germany accounted for about 2 percent.

### A. USSR.

#### 1. Resources.

The major weakness in the Soviet tin industry appears to be a shortage of economically exploitable tin ore resources. Before 1930 the USSR was considered to be almost completely deficient in tin ore resources. 1/\* From 1930 2/ to the present time the USSR has been engaged in a determined effort to discover and develop

\* For serially numbered source references, see Appendix D.

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new deposits. 3/ Of the total funds available to the Peoples Commissariat of Nonferrous Metals in 1940 for prospecting, 11.5 percent was allocated to the search for tin ore resources, an amount exceeded only by that allocated to gold prospecting. 4/ As a result of this program, many relatively small deposits, both lode and placer, were discovered in East Siberia, the Far East, and Kazakhstan and Central Asia (Economic Regions XI, XII, and X, respectively),\* leading to claims of large Soviet tin ore resources. In 1944, for example, Soviet officials claimed that tin ore resources in the USSR had been increased from a negligible quantity to a point where they were exceeded only by those of Southeast Asia (presumably including southern China) and Bolivia, 5/ indicating resources of 300,000 to 500,000 tons of contained metal. On the other hand, much of these tin ores probably are not exploitable under prevailing technological and economic conditions. Almost all of the deposits are situated in areas that are extremely remote from urban centers, and climatic conditions are adverse. 6/ Many of the deposits are very low in tin content. The ores in the Sherlovaya Gora mine in Chitinskaya Oblast average 0.18 percent tin content, 7/ those in the Onon mine in Chitinskaya Oblast average 0.6 percent tin content, 8/ and the Sinancha ores in Primorskiy Kray contain only 0.03 percent tin. 9/ These tin content percentages may be compared with the complex, lode ores of Bolivia, which range between 2 and 6 percent tin content. Finally, some of the deposits are very complex, and the ores are difficult to beneficiate, such as those at Khapcheranga in the Chitinskaya Oblast and at the various mines in the Tetyukhe-Kavalerovo area of Primorskiy Kray. 10/ It should be noted that although the Sixth Five Year Plan (1956-60) contains no reference to increased production of tin, provision is made for increasing the 1960 geological prospecting for tin ore resources to 55 to 60 percent above the 1955 level. 11/

\* See the map, inside back cover. The term region in this report refers to the economic regions defined and numbered on CIA Map 13702 (4-55), USSR: Administrative Divisions and Economic Regions, January 1955.

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An illustration of the difficulties encountered in the Soviet tin industry as a result of the inadequacy of resources is the situation at Dal'stroy,\* which produces between one-fourth and one-fifth of the total mine output in the USSR. Operating costs in the Dal'stroy area are far more than the selling price of its production.

[ ] in 1955. [ ]  
[ ] which indicates a ruble/dollar ratio of over 60 to 1. In addition to the high price paid, Dal'stroy producers received a subsidy of 70 percent of the price paid. 15/ In spite of both high prices and the subsidy, Dal'stroy producers operated at a loss in both 1954 and 1955. 16/

The major areas of tin ore deposits in the USSR now being mined are the Chitinskaya Oblast; the Khingan area in the Yevreyskaya Autonomous Oblast; the Tetyukhe-Kavalerovo area in Primorskiy Kray 17/; [ ]  
[ ] and Omsukchan in the Magadanskaya Oblast, and Ege-Khaya in Yakutskaya ASSR 19/; and scattered deposits in Vostochno-Kazakhstanskaya Oblast, Tadzhik SSR, and Kirgiz SSR. \*\* 20/

\* Dal'stroy is the Chief Directorate of Construction of the Far North, created in 1932 for the purpose of exploiting the mineral resources of that area. 12/ Until March 1953, Dal'stroy was subordinate to the Ministry of Internal Affairs (MVD). At that time it was transferred to the newly formed Ministry of the Metallurgical Industry. Upon the reorganization of that Ministry in February 1954, Dal'stroy became subordinate to the Ministry of Nonferrous Metallurgy. 13/

\*\* See the map, inside back cover.

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## 2. Mining and Concentrating Facilities.

### a. Mines.

Soviet tin mines generally are relatively small installations scattered over large areas of the Asiatic USSR and extending into Outer Mongolia.\* The available data on Soviet tin mines include numerous references to both underground and open-pit operations. Many of the Soviet tin mines contain other metals also. Tungsten, for example, is produced at the Onon mine in Chitinskaya Oblast, 22/ at the mines of the East Siberian Tin Combine, 23/ and at Iul'tin in Magadanskaya Oblast 24/; lead, zinc, and silver are produced in the tin mines in the Tetyukhe-Kavalerovo area of Primorskiy Kray 25/; and gold may be a byproduct of some of the tin mines in the Dal'stroy area.

### b. Concentrating Plants.

The Soviet concentrating plants are located at or near the tin mines. 26/ The most commonly used ore beneficiation process is gravity concentration by washing, 27/ but the flotation process is used at several places where the separation of sulfide minerals from the tin oxide (cassiterite) is necessary. 28/ Concentrating plants using the flotation process include those at Khapcheranga in Chitinskaya Oblast; 29/ at Sinancha in Primorskiy Kray, 30/ and at Lazo in Magadanskaya Oblast. 31/ The recoveries achieved by the Soviet concentrating plants usually are low, largely because of the complex nature of the ores. At the Onon plant in Chitinskaya Oblast in 1938, for example, the metal recovery was reported to have been only 60 percent. 32/ Where tin ores are relatively simple, as in Malaya, recoveries are much higher, but in the concentrating plants on the Island of Tasmania and in Cornwall, England, which treat complex ores similar to some of the Soviet ores, metal recoveries average 75 percent and from 60 to 70 percent, respectively. 33/ Although

\* Tin mines in Outer Mongolia are operated by the USSR under lease agreements. 21/

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it is probable that improvements over the 1938 level in the USSR have been achieved, it is unlikely that the present recovery rate is more than about 70 percent.

3. Metal Producing Facilities.

In contrast to the tin mining and concentrating facilities that are widely scattered throughout Economic Regions X, XI, and XII, the smelting and refining facilities are confined to two locations, both far from the mining and concentrating facilities. The two locations are Podol'sk, south of Moscow, and Krisvoshchakova, across the Ob' River from Novosibirsk.\* The plant at Podol'sk, which began operating in 1934, was designed principally to treat the complex tin concentrates produced in the Chitinskaya Oblast. Undamaged during World War II, this plant has operated continuously since it was built, 34/ and its production is estimated to be about 1,400 tons of tin per year.\*\* The plant at Krisvoshchakova, also known as the Novosibirsk Plant, as the Chenskaya Plant, and as Plant 520, began operating in 1942. 35/ Its production is estimated to have been about 8,400 tons in 1955,\*\* about 86 percent of the estimated total for the USSR. The metal recovery achieved in Soviet smelting and refining plants is estimated to be 90 percent. In 1941 the planned recovery was 88 percent, 36/ but some improvements probably have been made since 1941.

Numerous reports have been received of construction, or planned construction, of tin metal producing facilities at Tetyukhe, Ege-Khaya, Khapcheranga, and Sherlovaya Gora. 37/

\* See the map, inside back cover.

\*\* For methodology, see Appendix B.

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4. Metal Production.

Although the production of tin metal in the USSR is estimated to have increased steadily from 1950 to 1955, 39/ the Fifth Five Year Plan (1951-55) goal is not believed to have been achieved. The Fifth Five Year Plan provided for an increase in production in 1955 to about 12,300 tons, 80 per- cent more than the actual production in 1950. 40/ Estimates of the production of tin in the USSR in 1950-55 are shown in Table 1.

Table 1

Estimated Production of Primary Tin  
in the USSR a/ 1951-55

Year	Metric Tons Amount
1950	6,800
1951	7,300
1952	7,900
1953	8,400
1954	9,100
1955	9,800

a. For methodology, see Appendix

B. The margin of error is plus or minus 20 percent. All figures are rounded to two significant digits.

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B. Communist China.

1. Resources.

Although a reliable, quantitative estimate of total tin ore resources in Communist China cannot be made at this time, investigations of the tin deposits by both Chinese and US engineers made before the Communist victory clearly indicate that the resources are very large. Based on general geological study, estimates made by these engineers ranged from 650,000 to 1.9 million tons of contained metal. 41/ The highest figure, 1.9 million, exceeds the estimated resources of Malaya, which are considered to be the largest in the world. Even the lower figure, 650,000, indicates that Chinese Communist tin resources are adequate to permit a substantial increase in production.

The Chinese Communist tin resources are confined to five southern provinces: Yunnan, Kwangsi, Kwangtung, Kiangsi, and Hunan. \*42/ The resources of Yunnan are by far the most important. The Ko-chiu area in this province traditionally has accounted for about 80 percent of the total Chinese production of tin. 43/ Here the ores average about 2 percent tin content. 44/ Outside of Yunnan Province, most of the Chinese tin ores are found in small placer deposits. 45/

2. Mining and Concentrating Facilities.

a. Mines.

The Ko-chiu area of Communist China contains hundreds of old pits and primitive underground workings. 46/ At the time of the Communist occupation, two large and relatively modern underground mines, the Lao-chang and the Hsin-ch'ang (Ma-la-kah) mines, and several hundred primitive, native\*\* mines were operating. 47/

\* See the map, inside back cover.

\*\* The word native as used in this report refers to primitive techniques and equipment which are peculiarly Chinese in origin.

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Since that time the Chinese Communists, with the aid of Soviet technical advice 48/ and equipment, 49/ have expanded and improved the Lao-chang and Hsin-ch'ang mines. The modernization includes improvements in ventilating systems, widening of haulage levels, and laying of underground rail lines. 50/ Although some of the old, native mines have been incorporated into these 2 major mines, as late as 1954 about 160 of the native mines were still operating under pre-Communist owners. Their production, however, had to be sold to the government-controlled Yunnan Tin Industry Company. 51/ Outside of the Ko-chiu area, most of the tin mines are open-pit operations. In Kwangtung, where tin occurs in association with tungsten in placer deposits, considerable effort has been made to expand production. 52/

b. Concentrating Plants.

The Chinese Communist tin concentrating plants generally are located at or near the producing mines. At the time of the Communist occupation, one semimodern plant in the town of Ko-chiu was in operation. It treated only the ores produced at the Hsin-ch'ang mine, recovering about 65 percent of the metal content. 53/ The ores produced at the Lao-chang mine and at the other small, native mines were treated in primitive mills in which the process consisted of puddling and sluicing. In such mills, metal recoveries were no greater than 55 percent and probably averaged lower than 55 percent. 54/

In 1953-54 the Chinese Communists erected a new modern concentrating plant at Ta-t'un, which had a capacity of 1,000 tons of ore per day. 55/ It was to treat the ores produced at the Lao-chang mine and other mines in the immediate vicinity. 56/ At the same time a new aerial tramway, 10 kilometers (km) long, was erected from Lao-chang to Ta-t'un to move the ore to the plant. 57/ In addition to the new Ta-t'un plant, the Chinese Communists have built several other small but modern concentrating plants in the Ko-chiu area to replace old, native mills. 58/ Insofar as is known, the old Ko-chiu mill continues to treat the ores mined at the Hsin-ch'ang mine.

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The tin ores in the Ko-chiu area are difficult to beneficiate efficiently because of the extreme fineness of the cassiterite grains -- much of which is lost in slimes. 59/ In 1946, Behre, Dolbear, and Company, a US engineering firm, conducted tests on typical samples of Ko-chiu ores and estimated that with the use of modern equipment and techniques recoveries of 70 to 75 percent could be achieved. 60/ In view of the modernization program, it is assumed that the new Ta-t'in plant probably is achieving recoveries of about 70 percent.

Outside of the Ko-chiu area, ore concentration is generally accomplished by sluicing. 61/ Because of the primitive equipment in use, the recoveries are very poor. In 1954 in Kwangsi Province, for example, the metal recovery in concentrating was reported to have been only 43 percent. 62/

### 3. Metal Producing Facilities.

At the time of the Communist occupation of China, the smelting facilities at Ko-chiu consisted of 1 blast furnace, with a capacity of about 2,500 tons of crude tin per year, and 18 small, crude, native furnaces 63/ with an average capacity each of about 1 ton of crude tin per day. 64/ The metal losses in the blast furnace averaged about 10 percent of the metal contained in the feed 65/ and ranged from 10 to 20 percent in the native furnaces. 66/ Chinese Communist press references 67/ indicate that the capacity for production of crude tin has been expanded and that the metal losses in the producing operation have been reduced. To achieve these results, the Communists may have reconstructed the old reverberatory smelting furnace which had been destroyed by the Japanese during World War II and also may have erected new smelting facilities. The replacement of the old, native smelting furnaces by new or reconstructed facilities would have reduced metal losses.

The annual refining capacity at Ko-chiu at the time of the Communist occupation was about 8,000 tons of tin metal averaging 99 percent tin content. 68/ Because of the presence of iron, lead,

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copper, and antimony impurities in the ores mined at Ko-chiu and, in turn, in the crude tin produced, the production of high-purity metal (99.8 percent) is very difficult. 69/ The Chinese Communists not only have increased the refining capacity at Ko-chiu but also are reported to have raised the average quality of the product. 70/ An electrolytic refining plant at Ko-chiu had been talked of before the Communist regime, 71/ but it is not known whether or not this plant has yet been installed. In 1953-54 there was erected in the Ko-chiu area a new power plant 72/ which possibly could have been for use by an electrolytic refining plant.

Outside of the Ko-chiu area there are several smaller smelting and refining centers. The most important of these is at Pa-pu in Kwangsi Province. 73/ The equipment in these smaller centers consists of native smelting furnaces and small reverberatory refining furnaces. 74/ On the basis of reports on operations in the native furnaces in the Ko-chiu area, it is estimated that losses in smelting in these other centers average between 10 and 20 percent. Because the tin concentrates treated by these centers are relatively free of impurities, high-purity metal is easily produced. The production at Pa-pu averages more than 99.6 percent tin content. 75/

#### 4. Metal Production.

The production of tin metal in Communist China increased sharply from 1950 to 1955, the increase averaging about 21.7 percent annually. The large increase in 1955 over 1954 of about 3,000 tons was the result both of higher recoveries in the concentrating process, obtained in the new Ta-t'un plant, and of increased ore production. Apparently the rate of increase exceeded even Communist expectations; in 1955, Communist China was able not only to ship its quota to the USSR but also to ship about 3,500 tons against 1956 allotments. 76/ Estimated production of primary tin in Communist China in 1950-55 is shown in Table 2.\*

\* Table 2 follows on p. 15.

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Table 2

Estimated Production of Primary Tin  
in Communist China a/  
1950-55

Metric Tons	
<u>Year</u>	<u>Amount</u>
1950	6,000
1951	7,300
1952	9,800
1953	10,700
1954	13,100
1955	16,000

a. For methodology, see Appendix B.  
The margin of error is plus or minus  
10 percent. All figures are rounded  
to the nearest 100 tons.

C. North Vietnam.

Several small tin mines in the Tinh-Tuc area of Tonkin in North Vietnam, from which a prewar average annual production of 500 to 600 tons of tin-in-concentrates was obtained, probably have resumed operations. 77/ Because the production is not smelted locally, it probably is shipped to Communist China in the form of concentrates 78/ and probably would be included in Chinese Communist production statistics.

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D. East Germany.

1. Resources.

In East Germany the tin resources consist of small ore deposits at Altenberg, Ehrenfriedersdorf, Sadisdorf, and Gottesberg, all in the Erzgebirge range along the Czechoslovak border. 79/ The tin ores in East Germany are very complex and are very low in tin content, averaging about 0.4 percent. Although the exploitation of these ores has been under way for a long time, production always has been very small. The present estimated production is the highest recorded in the twentieth century. 80/ Because of the high production costs resulting from the poor quality of the ores, 81/ a reassessment of the industry was made in 1953 to determine the feasibility of obtaining all tin supplies from imports. 82/ Although the conclusions of this reassessment are not definitely known, tin ores in East Germany continue to be mined and smelted.

2. Mining and Concentrating Facilities.

Three firms in East Germany produce tin concentrates: the VEB Altenberg Tin Mines, operating the Altenberg, Sadisdorf, and Zinnwald mines; the VEB Ehrenfriedersdorf Tin Mines, operating the Ehrenfriedersdorf (Sauberg) mine, and the VEB Rodewisch Tungsten and Tin Mines, operating the Gottesberg mine. 83/ Because of the complex nature of the ores, 84/ beneficiation is very difficult. In 1951 the planned recovery at the Altenberg mill, the largest in East Germany, was to be only about 50 percent. 85/

3. Metal Producing Facilities.

There is only one tin smelting and refining plant in East Germany, the VVB Buntmetall Zinnhuetten at Freiberg. This plant produces a crude tin averaging about 99 percent tin content, and metal losses are about 13 percent in the operation. 86/ For use in the manufacture of some industrial alloys, this product is

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not further refined. 87/ To supply the requirements for metal of higher purity, however, a part of the production of crude tin is refined by electrolysis to 99.8 percent tin content. 88/

4. Metal Production.

Because only a part of the crude tin produced in East Germany is refined, the remainder being consumed as produced, the production of crude tin is the best measure of East German tin production. Estimated production of crude tin (99 percent) and refined tin (99.8 percent) in East Germany in 1950-55 is shown in Table 3.

Table 3

Estimated Production of Crude Tin (99 Percent) and Refined Tin (99.8 Percent) in East Germany a/  
1950-55

Metric Tons		
<u>Year</u>	<u>Crude Tin</u>	<u>Refined Tin</u>
1950 <u>b/</u>	165	79
1951 <u>b/</u>	220	137
1952	384 <u>c/</u>	147 <u>d/</u>
1953 <u>e/</u>	476	140
1954 <u>f/</u>	602	189
1955 (plan) <u>g/</u>	600	225

a. The margin of error is plus or minus 5 percent.

b. 89/

c. 90/

d. 91/

e. 92/

f. 93/

g. 94/

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III. Trade.

The Sino-Soviet Bloc does not export tin metal; therefore, all Bloc trade in tin consists of imports. From 1950 to 1955, Bloc imports ranged from an estimated maximum of about 6,700 tons in 1951 to a minimum of about 1,600 tons in 1954. During this period, Bloc imports of tin have been decreasing, both in terms of actual tonnages and in terms of the relative importance to the total Bloc supply. From 1950 to 1951, for example, imports averaged about 5,600 tons per year, which represented an annual average of about 29 percent of the total Bloc supply. From 1953 to 1955, however, imports averaged about 2,100 tons per year, representing an annual average of only about 8 percent of the total supply. The principal reason for the decline in imports of tin has been the rapid increase in Chinese Communist production.

Since November 1952 the export of tin to Communist China has been embargoed by international agreement, but for the rest of the Bloc no international legal restrictions on exports of tin have been imposed. Before April 1954, tin was on International List III, which required only that exporting countries report to the Coordinating Committee on Export Control (COCOM) any shipments of tin metal made to the Bloc. Since April 1954, tin metal has not appeared on COCOM listings..

Although primary sources of tin imports by the Sino-Soviet Bloc have varied considerably from year to year, two countries have continued to supply the bulk of the Bloc imports during 1950-55. Of a total of about 19,700 tons of tin metal estimated to have been imported during this period, the known and probable shipments from Malaya accounted for about 46 percent and those from the Netherlands, for about 31 percent. Imports of tin metal by the Sino-Soviet Bloc, by source, in 1950-55 are shown in Table 4.\*

\* Table 4 follows on p. 19.

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Table 4

Imports of Tin Metal by the Sino-Soviet Bloc, by Source a/  
1950-55

Source	Metric Tons					
	1950	1951	1952	1953	1954	1955
Malaya	639	4,797	1,372	1,339	914	0
Netherlands	2,173	521	355	708	487	1,784
UK	1,001	264	269	204	10	0
Belgium	15	200	0	0	0	0
Indonesia	31	5	102	153	0	0
Other <u>b/</u>	497	890	233	267	157	198
Total	<u>4,400</u>	<u>6,700</u>	<u>2,300</u>	<u>2,700</u>	<u>1,600</u>	<u>2,000</u>

a. Figures for the individual countries are derived from Appendix A. Totals are rounded to two significant digits. The margin of error is plus 10 percent to minus 5 percent.

b. This category includes a 10-percent margin to cover unreported shipments plus small known shipments from other countries.

#### IV. Supply of Primary Tin.

Because tin metal is not exported by the Sino-Soviet Bloc, the available Bloc supply consists of production plus imports. The estimated supply of primary tin in the Sino-Soviet Bloc in 1950-55 is shown in Table 5.\*

\* Table 5 follows on p. 20.

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Table 5

**Estimated Supply of Primary Tin in the Sino-Soviet Bloc a/  
1950-55**

					Metric Tons
Production					
Year	USSR <u>b/</u>	Communist China <u>c/</u>	East Germany <u>d/</u>	Imports <u>e/</u>	Total Supply <u>f/</u>
1950	6,800	6,000	200	4,400	17,000
1951	7,300	7,300	200	6,700	22,000
1952	7,900	9,800	400	2,300	20,000
1953	8,400	10,700	500	2,700	22,000
1954	9,100	13,100	600	1,600	24,000
1955	9,800	16,000	600	2,000	28,000

a. Totals are rounded to two significant digits. The margin of error is plus or minus 15 percent.

b. Figures from Table 1, p. 10, above.

c. Figures from Table 2, p. 15, above.

d. Figures from Table 3, p. 17, above, and rounded to the nearest 100 tons.

e. Figures from Table 4, p. 19, above.

f. Sum of figures given under "Production" and "Imports."

V. Demand.

A. Total Demand.

1. USSR.

Evidence relating directly to the demand for tin in the USSR is extremely scarce. The only definite information available is a statement of the consumption of tin in 1937. Because,

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however, the consumption of tin, excluding that used in the production of tinplate, is almost entirely in the form of industrial alloys -- such as bronze, babbitt, and solder, which are used, directly or indirectly, in almost every sector of industry -- it follows that consumption of tin, if use in tinplate is excluded, should follow trends in industrial production. An examination of the consumption of tin in 1937, excluding use in tinplate, in six major countries, including the USSR, reveals a close relationship between industrial production and consumption of tin in each country.\*

Because of technological developments from 1937 to 1955 the rate of tin consumption, excluding use in tinplate, to industrial production has declined. Over the past two decades, all of the major tin-consuming countries of the world, including the USSR, have been engaged in intensive research efforts to develop substitutes or alternative materials for tin products.\*\* As a result of these efforts, many substitutes or alternative materials have been developed, and there has been a downward shift

\* For methodology, see Appendix B.

\*\* The reasons for the search for substitutes or alternative materials for tin products include:

1. A serious tin shortage existed during World War II. None of the major belligerents was self-sufficient in tin supplies. Early in the war, Southeast Asia, the most important tin-producing area in the world, was overrun by the Japanese and eliminated as a tin supplier.
2. Since World War II the major tin-producing areas have been located in relatively vulnerable positions. The most important tin-producing area within the Sino-Soviet Bloc is southern China, immediately adjacent to the Indochina border. Southeast Asia, the largest supplier of tin outside the Bloc, is in constant danger of Communist envelopment.
3. Tin metal commands a relatively high price (currently selling for about US \$1.00 a pound), which encourages the development of substitutes.

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of the ratio of tin consumption to industrial production. During 1937-55 the relationship between tin consumption and industrial production in the USSR is believed to have remained close to that relationship in the West because the Soviet equipment that has been examined usually contains alloys with compositions similar to those used in the West.

It is probable that from 1937 to the present the production and use of secondary metal has not materially affected the relationship of primary tin consumption, excluding use in tinplate, to industrial production. The supply of scrap available for secondary metal recovery is dependent primarily on the extent of industrial production. Over time, this supply tends to follow the same pattern. The use of tin in the production of tinplate, the one use for which secondary metal is neither used nor recovered, is excluded from the calculation.

On the basis of these considerations, it appears that demand for tin, excluding use in tinplate, can be estimated from industrial production. A statistical relationship between demand for tin, excluding tinplate requirements, and industrial production in the USSR has been developed by analogy to experience in the UK, France, Belgium, and Italy.\* Estimates of the probable demand for tin in the USSR for uses other than the production of tinplate were obtained from reported consumption of tin in 1937 and from an index of industrial production in the USSR for 1937-55.

An estimate of the quantity of tin consumed in the production of tinplate in the USSR was obtained from an estimate of the production of tin cans in 1951, indicating a consumption of about 1,800 tons of tin in tinplate. <sup>95/</sup> When added to the estimated demand for tin in uses other than tinplate, the tin used in tinplate

\* Analogy was made to the Western European countries of the UK, France, Belgium, and Italy instead of to the US because the use pattern and state of technology of those countries is believed to approximate more closely those of the USSR than do those of the US.

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was about 14 percent of the total. In 1937 the reported consumption in tinplate was 12.4 percent of the total. Estimates of use in tinplate for 1950-55 were calculated by assuming that the 14-percent figure remained constant for the whole period.

Estimates of total consumption of tin in the USSR consist of the sum of estimates of tin demand for the production of tinplate and of estimates of tin demand for other uses.

2. European Satellites and Communist China.

Although the demand for primary tin in the individual European Satellites and in Communist China is small, the aggregate demand is substantial, representing roughly one-fourth of the total demand of the Sino-Soviet Bloc. The estimates for the individual countries were derived by the same technique as that used to derive the estimates for the USSR. Estimated demand for primary tin in the Sino-Soviet Bloc in 1950-55 is shown in Table 6.

Table 6

Estimated Demand for Primary Tin in the Sino-Soviet Bloc a/  
1950-55

Country	Metric Tons					
	1950	1951	1952	1953	1954	1955
USSR	11,300	12,900	13,900	15,200	17,700	20,100
Communist China	500	500	500	500	500	500
Bulgaria	200	200	200	300	300	300
Czechoslovakia	1,400	1,500	1,700	1,900	2,000	2,200
East Germany	800	900	1,000	1,100	1,200	1,200
Hungary	500	600	700	700	800	900
Poland	1,100	1,200	1,300	1,700	1,800	2,000
Rumania	300	300	300	400	400	400
Total	<u>16,000</u>	<u>18,000</u>	<u>20,000</u>	<u>22,000</u>	<u>25,000</u>	<u>28,000</u>

a. For methodology, see Appendix B. Figures for individual countries are rounded to the nearest 100 tons; totals, to 2 significant digits. The margin of error is plus or minus 20 percent.

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B. Use Patterns.

1. USSR.

The only available evidence relating directly to the distribution of primary tin within the USSR is a statement of the 1937 use pattern. 96/ The use pattern of primary tin in the USSR in 1937 is shown in Table 7. Because the ultimate uses of tin throughout industry are so varied, the 1937 pattern cannot be translated to the present situation on a quantitative basis. On the basis of shifts in use patterns elsewhere in the world, however, the probable direction of changes in the Soviet use pattern since 1937 can be established.

Table 7

Use Pattern of Primary Tin in the USSR a/  
1937

Use	Quantity (Metric Tons)	Approximate Percent of Total
Bronze and brass	3,920	35
Babbitt	3,705	33
Solder	1,300	12
Tinplate	1,405	12
Other	970	8
Total	<u>11,300</u>	<u>100</u>

a. 97/

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Bronze and Brass: The proportionate demand for tin in the form of bronze and brass in the USSR probably has risen. Bronze is especially valuable in industrial applications because it resists corrosion and shock and is relatively easy to machine. In the US the proportionate consumption of tin in the production of bronze and brass has increased substantially. 98/

Babbitt: The proportionate demand for tin for the production of babbitt in the USSR probably has declined. In the search for substitutes for tin products by the major tin-consuming countries, considerable success was achieved in developing substitutes for babbitt. Examples include powdered metal bearing materials, plastic bearing materials, and lead-base bearing materials. 99/ The USSR has claimed some success in this area of tin substitution. 100/ In the US the proportionate requirement for tin in the production of babbitt has declined. 101/

Solder: The proportionate demand for tin in the production of solder in the USSR probably has increased slightly. Although low tin solders have been developed, increasing solder requirements resulting from the rapidly expanding production of electrical equipment probably has more than offset the savings obtained by the use of the new solders, as has happened in the US. 102/

Tinplate: The proportionate demand for tin for the production of tinplate in the USSR probably has increased. On the basis of an estimate of the number of tin cans produced, it is estimated that in 1951 about 1,800 tons of tin, 14.0 percent of the total estimated tin consumption in 1951, was consumed in the form of tinplate. 103/ It is reported that in 1937, 12.4 percent was used for tinplate. In the West, especially in the US, the introduction of the electrolytic technique in the production of tinplate has reduced tin requirements per ton of tinplate by as much as 50 percent. In the USSR, however, the use of this method is not yet widespread.

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It is interesting to note the wide difference in the relative importance of tinplate requirements for tin in the USSR and in the US. Tinplate requirements have been estimated to have been about 14 percent of total requirements in the USSR in 1951; during 1947-54 in the US an average of 56 percent of the tin consumption was used in the production of tinplate. 104/

## 2. European Satellites.

Although the use pattern of tin in the European Satellites varies considerably from country to country, the proportion of tin used in the production of industrial alloys such as bronze, babbitt, and solder generally is relatively high in comparison with the proportionate demand in the UK and in the US. Tinplate, for example, is known to be produced only in Poland, 105/ Czechoslovakia, 106/ and Rumania. 107/ Because a large part of the tin supplies required by the various Satellites is obtained through imports of semimanufactures and finished products, a use pattern for tin does not show accurately the actual proportionate use of tin in all forms by these countries. For example, of a total bronze supply of 4,500 tons in East Germany in 1953, 108/ about 2,000 tons were imported as bronze metal. 109/

## VI. Supply-Demand Balance.

The estimated primary tin supply-demand balance in the Sino-Soviet Bloc in 1950-55 is shown in Table 8.\* The tin supply-demand balance during 1950-55 indicates a net surplus of about 4,000 tons, all or part of which may have been added to tin stocks in the USSR. Tin is stocked in at least two depots in the USSR: at Kirov, 58°35' N - 49°40' E, and at Sokolniki, a suburb of Moscow. The existence of these stocks has been established by reports of returning prisoners of war who claim to have either seen or handled the metal in the depots. 110/ One prisoner of war claims to have seen the word BANKA stamped on stored tin ingots. 111/ Because BANKA is the trademark of the Dutch firm N. V. Gemeenschappelijke Mijnbouwmaatschappij Billiton for tin metal produced from ores mined on the Island of Banka, Indonesia, it is almost certain that this prisoner saw tin metal.

\* Table 8 follows on p. 27.

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Table 8  
Estimated Primary Tin Supply-Demand Balance in the Sino-Soviet Bloc  
1950-55

Metric Tons			
<u>Year</u>	<u>Supply a/</u>	<u>Demand b/</u>	<u>Net Surplus or Deficit</u>
1950	17,000	16,000	+ 1,000
1951	22,000	18,000	+ 4,000
1952	20,000	19,000	0
1953	22,000	22,000	0
1954	24,000	25,000	- 1,000
1955	28,000	28,000	0
Total	<u>133,000</u>	<u>128,000</u>	<u>+ 4,000</u>

- a. Figures from Table 5, p. 20, above.  
b. Figures from Table 6, p. 23, above.

The existing stocks of tin in the USSR are tentatively estimated at 11,000 to 15,000 tons. At the end of World War II the USSR is estimated to have accumulated stocks of about 11,000 tons.\* It is doubtful that from 1946 to 1949 the USSR added important quantities to its tin stocks; tin supplies were known to have been scarce during these years. <sup>112/</sup> The estimated supply-demand balance of tin for the entire Sino-Soviet Bloc from 1950 to 1955,\*\* however, indicates a surplus of 4,000 tons. All of the surplus is believed to have been added to Soviet stocks. Assuming a complete cessation of production in the Bloc and of all imports, the estimated stocks would be adequate to meet the estimated Soviet demand for tin at current levels for about 7 to 10 months, or of the entire Bloc for from 5 to 7 months.

\* For methodology, see Appendix B.

\*\* See Table 8.

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There is no evidence of any strategic stocks of tin in the European Satellites or in Communist China. Where state reserves are maintained, as in East Germany, the apparent purpose is to control distribution, 113/ and such stocks must be considered as working inventories. On the basis of the general practice in the West, it is estimated that working inventories would contain about 2 months' supply of tin, about 4,000 tons for the entire Sino-Soviet Bloc.

VII. Consumption of Tin Ore Resources.

A. Total Mine Production.

Estimates of production of tin ore in the Sino-Soviet Bloc (or conversely of tin ore consumed by the Bloc tin industry) are obtained for the various producing countries in the Bloc from the estimated production of tin metal; the estimated average metal content of the ores mined; and the metal losses resulting from concentrating, smelting, and refining processes. The only significant change occurring during 1950-55 was in the Ko-chiu area of Yunnan Province in Communist China, where the erection of new concentrating facilities is estimated to have resulted in substantial reduction in metal losses. The relatively large production of tin ore in East Germany is a direct reflection of the very low metal content of the ores mined. Estimated production of tin ore in the USSR, Communist China, and East Germany in 1950-55 is shown in Table 9.\*

B. Regional Distribution.

1. Communist China.

The production of tin ore in Communist China is concentrated in 1 small area about 30 km by 20 km, centered around the town of Ko-chiu in Yunnan Province. 114/ This area always has produced about 80 percent of the total Chinese production and is believed to be continuing to do so. The other 20 percent of the production is scattered through the 4 southern provinces of Kwangsi, Kwangtung, Kiangsi, and Hunan. Of these, Kwangsi and Kwangtung are the more important.

\* Table 9 follows on p. 29.

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Table 9

Estimated Production of Tin Ore  
in the USSR, Communist China, and East Germany  
1950-55

Thousand Metric Tons				
Year	USSR	Communist China	East Germany	Total
1950	1,080	780	90	2,000
1951	1,160	940	130	2,200
1952	1,250	1,270	220	2,700
1953	1,340	1,380	270	3,000
1954	1,440	1,690	350	3,500
1955	1,550	1,890	340	3,800

a. Figures for individual countries are rounded to the nearest 10,000 tons; totals, to 2 significant digits. For methodology, see Appendix B. The margin of error is plus or minus 30 percent.

2. USSR.

No one single area dominates production of tin ore in the USSR as is the situation in Communist China. In the USSR, tin ore is produced by a large number of relatively small mines scattered in 5 general areas, one of which, Dal'stroy, includes about 5 or 6 large mining areas. Although production in some of the mining areas decreased in the 1950-55 period, national production appears to have increased steadily (see Table 9). In the Dal'stroy area, for example, production of the Chaun-Chukotka Mining Industry Directorate at Pevek, the largest single producer in this area, declined in both 1954 and 1955. 115/

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Press releases indicate that in the Khingan area the rate of increase was substantially above the national average. 118/ It is doubtful that production of tin ore has increased in Kazakhstan and Central Asia, where the tin ores occur in very low-grade deposits. Estimated regional distribution of production of tin concentrates in the USSR in 1955 is shown in Table 10.

Table 10

Regional Distribution of Production of Tin Concentrates in the USSR a/  
1955

Mining Area	Metric Tons <u>b/</u>			Approximate Percent of Total Soviet Production	
	<u>Economic Region</u>				
	<u>X</u>	<u>XI</u>	<u>XII</u>		
				<u>Total Production</u>	
Khingan			3,000	3,000	31
Tetyukhe-Kavalerovo			2,300	2,300	24
Dal'stroy		400	1,700	2,100	21
Chitinskaya Oblast		1,600		1,600	16
Kazakhstan and Central Asia	800			800	8
Total	800	2,000	7,000	9,800	100

a. For methodology, see Appendix B. The margin of error is plus or minus 40 percent. All figures are rounded to the nearest 100 tons.

b. Recoverable metal content.

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VIII. Capabilities, Vulnerabilities, and Intentions.

A. Capabilities.

Judged on the basis of tin ore resources, the Sino-Soviet Bloc as a whole can expand production of tin during the next 10 years. This potential increase, however, is confined largely to Yunnan Province in southwestern Communist China, where tin ore resources have been estimated to be among the largest in the world. <sup>119/</sup> During 1950-55, production of tin in China increased 167 percent, while the total production of the Bloc increased about 100 percent. It is believed that in the future, tin production in China will increase faster than in other producing areas of the Bloc. The magnitude of China's potential for production of tin is evident from the plans of the old Nationalist government of China, which called for an eventual production of 30,000 tons annually; <sup>120/</sup> a quantity larger than the total for the entire Bloc in 1955. It should be noted, however, that such an increase would require some capital investment in mining, smelting, and refining facilities. The expansion of production in China during the past 6 years was achieved with the aid of Soviet equipment and technical assistance -- the Ko-chiu mining area development was one of the Soviet Aid Key Projects\* <sup>121/</sup> -- and it is probable that Soviet assistance will be used in any major future expansion.

In the USSR, an increase in production of tin would be much more difficult than in Communist China. Neither the Fourth nor the Fifth Five Year Plan goals were achieved. The major deterrent to increasing production in the USSR is believed to be the lack of adequate resources that are economically exploitable. Because geological prospecting has developed numerous small and low-grade tin ore deposits over a very large area in Economic Regions X (Kazakhstan and Central Asia), XI (East Siberia), and XII (Far East), however, it is possible that further search in this relatively unexplored country may develop larger

Through a "Soviet Aid Program," the USSR has assisted Communist China with technical advice and equipment in 141 specific industrial development projects, one of which was the development of the Ko-chiu mining area.

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and/or richer deposits. The Sixth Five Year Plan provides for an increase in 1960 in geological prospecting for tin ore resources of 55 to 60 percent above the 1955 level. 122/ The specific areas with the greatest potential for increased production, according to the growth in the past 6 years, are the Khingan area, the Tetyukhe-Kavalerovo area, and possibly the large area under the control of Dal'stroy.

Production of tin in East Germany is based on extremely poor ores in an area which has been mined for the past 800 or 900 years. Hence the discovery of better ores is unlikely. No major increases in production in East Germany are anticipated, and it is doubtful that current levels can be maintained over an extended period.

Although it is believed that the Sino-Soviet Bloc is capable of increasing the production of tin by a substantial amount during the next 10 years, it is also probable that the demand for tin will increase in proportion to increases in industrial production. Furthermore, if the demand for consumer goods forces a major increase in the production of tinplate, the demand for tin would increase more rapidly. In any event, no large surpluses of production over demand are probable in the foreseeable future.

#### B. Vulnerabilities.

Under present conditions, the production of tin in the Sino-Soviet Bloc appears to be almost adequate to meet demand, and production in 1955 is estimated to have been only about 2,000 tons less than the estimated demand. Almost all of the production, however, is confined to southwestern Communist China and to scattered installations in the Asiatic USSR, all of which are remote from the major consuming areas in the European USSR and the European Satellites. Furthermore, one general area, southern China, produced about 62 percent of the total production in 1955, and the production potential indicates that this percentage probably will increase in the future. The European Satellites depend almost entirely on imports for supplies.

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Because all of the major tin-consuming countries of the world, including the USSR, have tried for many years to reduce dependence on tin products, it is unlikely that the Sino-Soviet Bloc requirements for tin could be further reduced significantly by the use of substitutes without a loss of industrial and/or military efficiency. Also, because the bulk of the Bloc demand is in industrial and military consumption, it is doubtful that much saving of tin could be accomplished by redirecting the use pattern to essential needs only.

C. Intentions.

Because tin is consumed in relatively small quantities in many indirect uses, both military and civilian, it is not, on the whole, a good indicator of intentions. Although tin has many indirect military applications, such as the use of bronze in naval equipment and of solder in electrical apparatus, the same alloys are equally essential in civilian use.

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## APPENDIX A

KNOWN AND PROBABLE IMPORTS OF TIN METAL  
BY THE SINO-SOVIET BLOC FROM WESTERN SOURCES  
1950-55

Table 11

Importing Country	Metric Tons					
	1950	1951	1952	1953	1954	1955
Albania	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0
Czecho- slovakia	1,027 <u>a/</u>	2,815 <u>b/</u>	366 <u>c/</u>	1,129 <u>d/</u>	548 <u>e/</u>	309 <u>f/</u>
East Ger- many	56 <u>g/</u>	262 <u>h/</u>	137 <u>i/</u>	25 <u>j/</u>	0	0
Hungary	464 <u>k/</u>	229 <u>l/</u>	121 <u>m/</u>	331 <u>n/</u>	71 <u>o/</u>	554 <u>p/</u>
Poland	1,575 <u>q/</u>	1,995 <u>r/</u>	915 <u>s/</u>	767 <u>t/</u>	792 <u>u/</u>	871 <u>v/</u>
Rumania	102 <u>w/</u>	406 <u>x/</u>	305 <u>y/</u>	152 <u>z/</u>	0	50 <u>aa/</u>
USSR	696 <u>bb/</u>	302 <u>cc/</u>	254 <u>dd/</u>	0	0	0
Total	<u>3,920</u>	<u>6,009</u>	<u>2,098</u>	<u>2,404</u>	<u>1,411</u>	<u>1,784</u>

- a. 809 tons from the Netherlands, 123/ 15 tons from Belgium, 124/ and 203 tons from the UK. 125/  
b. 2,507 tons from Malaya, 126/ and 308 tons from the Netherlands. 127/  
c. 122 tons from Malaya, 128/ and 244 tons from the Netherlands. 129/  
d. 623 tons from Malaya, 130/ 403 tons from the Netherlands, 131/ 102 tons from Indonesia, 132/ and 1 ton from the UK. 133/  
e. 152 tons from Malaya 134/ and 396 tons from the Netherlands. 135/  
f. All from the Netherlands. 136/  
g. All from Malaya. 137/  
h. 40 tons from the Netherlands, 138/ 210 tons from West Germany, and 12 tons from Austria. 139/

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Table 11  
(Continued)

- 
- i. All from Malaya. 140/
  - j. All from Malaya. 141/
  - k. 102 tons from the UK, 142/ 96 tons from Malaya, 143/ 174 tons from the Netherlands, 144/ 61 tons from Denmark, 145/ and 31 tons from Indonesia. 146/
  - l. 36 tons from the UK, 147/ 20 tons from Malaya, 148/ and 173 tons from the Netherlands. 149/
  - m. 15 tons from the UK, 150/ 46 tons from Malaya, 151/ and 60 tons from the Netherlands. 152/
  - n. 51 tons from the UK, 153/ 127 tons from Malaya, 154/ and 153 tons from the Netherlands. 155/
  - o. 10 tons from the UK 156/ and 61 tons from Malaya. 157/
  - p. All from the Netherlands. 158/
  - q. 1,190 tons from the Netherlands 159/ and 385 tons from Malaya. 160/
  - r. 1,864 tons from Malaya, 161/ 5 tons from Indonesia, 162/ and 126 tons from the UK. 163/
  - s. 864 tons from Malaya 164/ and 51 tons from the Netherlands. 165/
  - t. 589 tons from Malaya, 166/ 127 tons from the Netherlands, 167/ and 51 tons from Indonesia. 168/
  - u. 701 tons from Malaya 169/ and 91 tons from the Netherlands. 170/
  - v. All from the Netherlands. 171/
  - w. All from Malaya. 172/
  - x. All from Malaya. 173/
  - y. 203 tons from Malaya 174/ and 102 tons from Indonesia. 175/
  - z. All from the UK. 176/
  - aa. All from the Netherlands. 177/
  - bb. All from the UK. 178/
  - cc. 200 tons from Belgium 179/ and 102 tons from the UK. 180/
  - dd. All from the UK. 181/

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APPENDIX B

METHODOLOGY

A. Production.

1. USSR.

The estimates of production of tin in the USSR were developed as follows:

- a. 1941-45: The production of tin metal in the USSR in 1945 was reported to have been 2.22 times that in 1940, 182/ which was an average annual increase of about 17.3 percent. On the basis of a statement by the Soviet ambassador   that Soviet production of tin metal was 150 to 170 tons per month, 183/ an estimate of 1,920 tons as production for 1941 was derived (12 x 160). Using the annual increase figure of 17.3 percent, an estimate for 1940 of 1,637 tons was obtained, and by applying the 1940-45 reported increase in production, an estimate of production of 3,634 tons was obtained for 1945.
- b. 1946: Soviet production in 1946 was reported to have been 19.1 percent greater than in 1945 184/; hence an estimate of 4,328 tons.
- c. 1947: Soviet production in the first 9 months of 1947 was reported to have been 17.1 percent greater than in the same period of 1946. 185/ Assuming that the rate of increase given remained constant in the last 3 months, an estimate of production in 1947 of 5,068 tons was obtained.

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- d. 1948: An estimate of 5,935 tons produced in the USSR in 1948 was obtained by extrapolation, assuming that the increase in 1948 over 1947 was 17.1 percent, based on the previous year.
- e. 1949-55: Estimated production of primary tin in the USSR in 1948-55 is shown in Table 12.

Table 12

Estimated Production of Primary Tin in the USSR  
1948-55

Year	Metric Tons		
	Total Estimated Production	Estimated Production at Novosibirsk	Estimated Production at Podol'sk
1948	5,935 <u>a/</u>	4,572 <u>b/</u>	1,363 <u>c/</u>
1949	6,383 <u>d/</u>	4,983 <u>e/</u>	1,400 <u>f/</u>
1950	6,831 <u>d/</u>	5,431 <u>e/</u>	1,400 <u>f/</u>
1951	7,320 <u>d/</u>	5,920 <u>e/</u>	1,400 <u>f/</u>
1952	7,853 <u>d/</u>	6,453 <u>e/</u>	1,400 <u>f/</u>
1953	8,434 <u>d/</u>	7,034 <u>e/</u>	1,400 <u>f/</u>
1954	9,067 <u>d/</u>	7,667 <u>e/</u>	1,400 <u>f/</u>
1955	9,757 <u>d/</u>	8,357 <u>e/</u>	1,400 <u>f/</u>

- a. Figure from d, 1948, above.
- b. 186/. This figure is based on tin shipments in 1 month (February) of 381 tons multiplied by 12 on the assumptions (1) that shipments equaled production and (2) that production remained relatively constant during the entire year.
- c. This figure is estimated total production less estimated production at Novosibirsk.
- d. This figure is the sum of estimated production at Podol'sk and at Novosibirsk.

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Table 12

Estimated Production of Primary Tin in the USSR  
1948-55  
(Continued)

e. From a statement that tin production at Novosibirsk in 1955 was 53.9 percent greater than in 1950, 187/ an average annual increase of 9.0 percent was obtained. Assuming that production in 1949 and 1950 also increased over the previous years by 9.0 percent, estimates for 1949-55 were developed.

f. Because almost all of the available data relating to the movement of tin concentrates to smelting plants give Novosibirsk as the destination, it is assumed that production at Podol'sk remains small. An arbitrary estimate of about 1,400 tons, based on the estimated production in 1948, was used to cover the probable production of this plant.

2. Communist China.

Estimated production of primary tin in Communist China, the pre-Communist peak and in 1950-55, is shown in Table 13.\*

B. Demand.

1. Relationship of Consumption of Tin to Industrial Production in 1937.

An examination of tin consumption, excluding that used in the production of tinplate, and of the industrial production of six major countries, including the USSR, in 1937 indicates a definite relationship between tin consumption and industrial production. In

\* Table 13 follows on p. 40.

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Table 13

Estimated Production of Primary Tin in Communist China  
Pre-Communist and 1950-55

Metric Tons	
Year	Estimated Production
Pre-Communist peak	15,865 <u>a/</u>
1950	6,045 <u>b/</u>
1951	7,298 <u>c/</u>
1952	9,828 <u>d/</u>
1953	10,712 <u>e/</u>
1954	13,090 <u>f/</u>
1955	16,000 <u>g/</u>

a. 188/

b. Production in 1950 was reported to have been 31.8 percent of the pre-Communist peak. 189/

c. Production in 1951 was reported to have been 46 percent of the pre-Communist peak. 190/

d. This figure was derived from the estimate for 1953 on the basis of a reported increase in 1953 over 1952 of 9 percent. 191/ <sup>21</sup>

e. The smelter production at Ko-chiu was reported to have been 77.2 percent greater in 1953 than in 1950. 192/ Because Ko-chiu is estimated to produce about 80 percent of the total Chinese Communist production, the percentage was applied to the total.

f. This figure was interpolated on the basis of an annual average increase during 1953-55 of 22.2 percent.

g. Exports of tin metal to the USSR in the first 11 months of 1955 were 15,039 tons. 193/ Because this figure included some 3,500 tons shipped against 1956 quotas and because there is no evidence of any shipments in December, it is believed that this figure represents the total exports during the year. Assuming that production at least equaled exports and allowing a small margin for exports to European Satellites and some Chinese Communist consumption, a

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Table 13

Estimated Production of Primary Tin in Communist China  
Pre-Communist and 1950-55  
(Continued)

production estimate of 16,000 tons for 1955 was obtained. Because the First Five Year Plan (1953-57) in China provides that production in 1957 will be 0.8 times greater than in 1952, 194/ or about 17,690 tons, it is believed that the 1955 production was not appreciably greater than 16,000 tons. If it were, it would indicate that the First Five Year Plan may have been achieved 2 years in advance, an unlikely development.

terms of the total tin consumption, excluding use for tinsplate, and of total industrial production of the countries examined, the proportionate relationships were developed. The relationships of consumption of tin to total industrial production in selected countries are shown in Table 14.

Table 14

Relationships of Consumption of Tin to Total Industrial Production  
in Selected Countries

<u>Country</u>	<u>Percentage of Total Industrial Production <u>a/</u></u>	<u>Tin Consumption (Metric Tons) <u>b/ c/</u></u>	<u>Percentage of Total Tin Consumption <u>b/</u></u>
US	53.93	30,582	48.07
UK	16.33	10,974	17.25
USSR	15.60	9,895 <u>d/</u>	15.55
France	7.87	7,664	12.05
Italy	3.93	2,943	4.62
Belgium	2.34	1,568	2.46
Total	<u>100.0</u>	<u>63,626</u>	<u>100.0</u>

a. 195/

b. These figures exclude tin used in tinsplate. The average for 1936-38 was used to avoid distortions resulting from changing inventories.

c. 196/, except where otherwise noted.

d. 197/

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The relationships shown in Table 14 are also true in terms of total world consumption of tin, excluding use for tinplate, and total world industrial production. Relationships of consumption of tin and total industrial production in selected countries to total world consumption of tin and total world industrial production are shown in Table 15.

Table 15

Relationships of Consumption of Tin and Total Industrial Production  
in Selected Countries to Total World Consumption of Tin  
and Total World Industrial Production

Country	Percentage of World Industrial Production <u>a/</u>	Tin Consumption (Metric Tons) <u>b/ c/</u>	Percentage of World Tin Consumption <u>b/</u>
US	34.41	30,582	30.34
UK	10.42	10,794	10.89
USSR	9.95	9,895 <u>d/</u>	9.82
France	5.02	7,664	7.60
Italy	2.51	2,943	2.92
Belgium	1.49	1,568	1.56
Total	<u>63.80</u>	<u>63,626</u>	<u>63.13</u>

a. 198/

b. These figures exclude tin used in tinplate. The average for 1936-38 was used to avoid distortions resulting from changing inventories.

c. 199/, except where otherwise noted.

d. 200/

2. Demand for Tin in the USSR.

The estimates of Soviet demand for tin for all uses except for tinplate were derived as follows: reported Soviet tin consumption in 1937 and an index of industrial production in the USSR during 1937-55 were modified to establish an index of probable demand for

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tin by analogous application of the effects on tin consumption caused by changes in industrial production in the UK, Italy, Belgium, and France. The reasons supporting the application of such an analogy to the Soviet situation are given in the text.\* An approximate ratio of tin demand to industrial production in the UK, France, Belgium, and Italy is shown in Table 16.

Table 16

Ratio of Tin Demand to Industrial Production  
in the UK, France, Belgium, and Italy

Country	Ratio of Industrial Production to Tin Consumption 1936-38 <u>a/</u>	Ratio of Industrial Production to Tin Consumption 1950-55 <u>a/</u>	Weights (Percentage of Total Industrial Production) 1950-55 <u>b/</u>
Belgium	100:100	100: 53	8
France	100:100	100: 47	26
Italy	100:100	100: 43	13
UK	100:100	100: 71	53
Weighted average		100: 60	

a. Industrial production index is an average from 201/. Tin consumption index is from 202/ and 203/.

b. These figures are derived from percentages of industrial production given in Tables 14 and 15, pp. 41 and 42, respectively, above.

From the above examples, a ratio of 1 to 0.60 for industrial production to tin demand during 1950-55 is derived when compared to a 1 to 1 ratio during 1936-38. The derivation of estimated total tin demand in the USSR in 1937 and 1950-55 is shown in Table 17.\*\*

\* P. 22, above.

\*\* Table 17 follows on p. 44.

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Table 17

Derivation of Estimated Total Tin Demand in the USSR  
1937 and 1950-55

Year	Industrial Production Index	Tin Demand Index (Excluding Tinplate Use)	Estimated Tin Demand (Ex- cluding Tinplate Use) (Metric Tons)	Estimated Tin Demand in Tinplate Use (Metric Tons)	Estimated Total Tin Demand (Metric Tons)
1937	100	100	9,895 <u>a/</u>	1,405 <u>a/</u>	11,300 <u>a/</u>
1950	164 <u>b/</u>	98 <u>c/</u>	9,697	1,579 <u>d/</u>	11,276 <u>e/</u>
1951	187 <u>f/</u>	112 <u>c/</u>	11,082	1,800 <u>g/</u>	12,882 <u>h/</u>
1952	202 <u>f/</u>	121 <u>c/</u>	11,973	1,949 <u>d/</u>	13,922 <u>e/</u>
1953	220 <u>f/</u>	132 <u>c/</u>	13,061	2,126 <u>d/</u>	15,187 <u>e/</u>
1954	257 <u>f/</u>	154 <u>c/</u>	15,238	2,481 <u>d/</u>	17,719 <u>e/</u>
1955	292 <u>f/</u>	175 <u>c/</u>	17,316	2,819 <u>d/</u>	20,135 <u>e/</u>

a. 204/b. 205/

c. This figure is derived from the industrial production index on the basis of a ratio of 1 to 0.60.

d. This figure is the difference between estimated total tin demand and estimated demand for uses other than for tinplate.

e. The demand for tin for tinplate in 1951 was 14 percent of total estimated tin demand (from g/ and h/, below). Assuming that the percentage of tin demand for tinplate remained constant during 1950-55, total tin demand estimates were calculated by the following formula:

$$\frac{\text{tin demand (less tinplate use)}}{0.86} = \text{total tin demand}$$

f. 206/g. 207/

h. This figure is the sum of estimates for tin demand for tinplate and tin demand for other uses.

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3. Total Demand for Tin in Communist China.

Because of a complete lack of data on tin demand in Communist China, a rough estimate of 500 tons annually was derived from pre-Communist data. Before the Communist occupation, the consumption of tin in China averaged only 400 tons per year, 208/ of which the major portion was used in tinfoil for religious observations, a practice which may have declined under the Communists. Traditionally, China has exported tin metal and imported tin alloys and tinplate in the form of semimanufactures and finished products, a practice believed to be followed today. Although the estimate of Chinese Communist consumption of tin is a rough approximation at best, when it is compared with estimates for the entire Sino-Soviet Bloc, the error probably is less than the rounding error.

4. Total Demand for Tin in the European Satellites.

As it was for the USSR, the demand for tin for the individual European Satellites was derived from reported prewar levels of tin consumption and indexes of industrial production modified to a probable tin demand index by the ratio developed above. Because tinplate is produced in only 3 of the Satellites, and because in each of these countries the consumption of tin in tinplate represents less than 5 percent of the total tin consumption, when calculating the estimated demand for tin in the Satellites no allowance was made for tin demand for the production of tinplate. Although the tin use patterns of the various Satellites have varied widely, it is believed that the over-all relationship of tin consumption to industrial production probably is relatively close to that of the USSR. The derivation of estimated total tin demand in the European Satellites in 1936-38 and 1950-55 is shown in Table 18.\*

C. Stockpiling in the USSR During World War II.

The estimate of the surplus of tin accumulated in the USSR during World War II consists of two parts: (1) stocks on hand at the end\*\*

\* Table 18 follows on p. 46.

\*\* Continued on p. 48.

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Table 18

Derivation of Estimated Total Tin Demand in the European Satellites  
1936-38 Average and 1950-55

Country	Year	Industrial Production Index <u>a</u> /*	Tin Demand Index	Estimated Tin Demand (Metric Tons)
Bulgaria	1936-38 average	100	100	218 <u>b</u> /
	1950	135	81 <u>c</u> /	177
	1951	155	93 <u>c</u> /	203
	1952	180	108 <u>c</u> /	235
	1953	196	118 <u>c</u> /	257
	1954	214	128 <u>c</u> /	279
	1955	237	142 <u>c</u> /	310
Czechoslovakia	1936-38 average	100	100	1,778 <u>b</u> /
	1950	132	79 <u>c</u> /	1,405
	1951	139	83 <u>c</u> /	1,476
	1952	155	93 <u>c</u> /	1,654
	1953	179	107 <u>c</u> /	1,902
	1954	186	112 <u>c</u> /	1,991
	1955	202	121 <u>c</u> /	2,151
East Germany <u>d</u> /	1949	100	100 <u>e</u> /	623 <u>f</u> /
	1950	145	127 <u>e</u> /	791
	1951	177	146 <u>e</u> /	910
	1952	207	164 <u>e</u> /	1,022
	1953	227	176 <u>e</u> /	1,096
	1954	250	190 <u>e</u> /	1,184
	1955	261	197 <u>e</u> /	1,227

\* Footnotes for Table 18 follow on p. 47.

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Table 18

Derivation of Estimated Total Tin Demand in the European Satellites  
1936-38 Average and 1950-55  
(Continued)

Country	Year	Industrial Production Index <u>a/</u>	Tin Demand Index	Estimated Tin Demand (Metric Tons)
Hungary	1936-38 average	100	100	673 <u>b/</u>
	1950	125	75 <u>c/</u>	505
	1951	149	89 <u>c/</u>	599
	1952	169	101 <u>c/</u>	680
	1953	182	109 <u>c/</u>	734
	1954	187	112 <u>c/</u>	754
	1955	216	130 <u>c/</u>	875
Poland	1936-38 average	100	100	1,495 <u>b/</u>
	1950	121	73 <u>c/</u>	1,091
	1951	136	82 <u>c/</u>	1,226
	1952	148	89 <u>c/</u>	1,331
	1953	179	107 <u>c/</u>	1,660
	1954	198	119 <u>c/</u>	1,779
	1955	225	135 <u>c/</u>	2,018
Rumania	1936-38 average	100	100	363 <u>b/</u>
	1950	118	71 <u>c/</u>	258
	1951	135	81 <u>c/</u>	294
	1952	150	90 <u>c/</u>	327
	1953	167	100 <u>c/</u>	363
	1954	178	107 <u>c/</u>	388
	1955	203	122 <u>c/</u>	443

a. 209/

b. 210/

c. This figure was calculated from the industrial production index on the basis of a ratio of 1 to 0.60.

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Table 18

Derivation of Estimated Total Tin Demand in the European Satellites  
1936-38 Average and 1950-55  
(Continued)

- 
- d. East German tin demand index calculated from the base year of 1949 rather than from the prewar level because data on prewar consumption are not available.
- e. Annual increase in the industrial production index calculated on the basis of a ratio of 1 to 0.60.
- f. Total available supply in East Germany in 1949 was 623 tons (103 tons of production 211/ and 520 tons of imports 212/). Because numerous references, such as 213/, indicate that tin supply was very short in 1949, it is assumed that the supply was about equal to consumption.

of 1941 were reported to have been about 3,500 tons, 214/ and (2) a derived excess of estimated supply over estimated consumption during 1942-45. The derivation of estimated stocks of tin in the USSR in 1945 is shown in Table 19. \*\*

D. Consumption of Tin Ore Resources.

1. Quantities Mined.

a. USSR.

Estimates of the quantities of tin ore mined in the USSR were derived from estimates of tin metal production, \*\* divided by the estimated recovery of metal contained in the ore in the concentrating, smelting, and refining process, \*\*\* and by the estimated average metal content of the ore mined. The latter figure

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\* Table 19 follows on p. 49.

\*\* See Table 12, p. 38, above.

\*\*\* See II, A, 3, p. 9, above.

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Table 19

Derivation of Estimated Stocks of Tin in the USSR  
1945

	Metric Tons
Estimated production of tin, 1942-45	11,628 <u>a/</u>
Imports of tin, 1942-45	48,920 <u>b/</u>
Total supply	<u>60,548</u>
Estimated consumption of tin, 1942-45	52,880 <u>c/</u>
Net surplus	<u>7,668</u>
Estimated stocks, end of 1941	<u>3,500 d/</u>
Estimated stocks, end of World War II	<u>11,168</u>

a. This figure is the total of individual estimates for 1942, 1943, 1944, and 1945 obtained from 1941 estimate of 1,920 tons. Applying the estimated average annual increase of 17.3 percent to each of these years yields the following figures for production in each of the years: ~~2,252~~, 2,642, 3,099, and 3,635 tons, respectively.

b. 215/

c. This figure is based on estimated consumption in 1943 which was derived as follows: Tin consumption in all uses except tinplate was calculated from industrial production which was reported as being 33.6 percent greater in 1943 than in 1937. 216/ The ratio of tin consumption to industrial production was assumed to have remained constant from 1937 to 1943. Thus an estimate of 13,220 tons for consumption in all

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Table 19

Derivation of Estimated Stocks of Tin in the USSR  
1945  
(Continued)

uses except tinplate was obtained from the 1937 consumption of 9,895 tons. 217/ No allowance was made for tinplate consumption in 1943 because (1) Soviet tinplate facilities, all in the European USSR before World War II, were destroyed early in the war, and (2) large quantities of tinplate were obtained from the US under Lend-Lease, satisfying Soviet requirements for tin in this form. The total consumption for 1942-45 was obtained by assuming that consumption remained relatively constant.

d. 218/

is estimated to have averaged about 1 percent in tin content because of the following factors: many of the mines in the Chitinskaya Oblast, Tetyukhe-Kavalerovo area, and Kazakhstan and Central Asia are mining ores well under 1 percent tin content.\* In Dal'stroy, on the other hand, the general practice appears to be to exploit a deposit for 1 or 2 years and then to abandon it, 219/ suggesting that a practice of "eye gouging"\*\*\* is being followed, which would indicate that the ores being mined probably are well over 1 percent tin content. For each year the following formula was used:

\* See II, A, 1, p. 5, above.

\*\* "Eye gouging" is the practice of mining only the richest portions of an ore deposit, called "eyes," and abandoning the remaining ore. Except for a few mining contractors operating under short-term leases, this practice is rarely followed in the West. "Eye gouging" is considered to be the mark of a disreputable operator because the end result is the wasting of a large part of the metal contained in the deposit. In the USSR, however, the urgency of meeting arbitrary and unrealistic production norms could easily force the operators into the practice.

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$$\frac{a}{b \times c \times d} = e$$

where a = estimated tin metal production in tons,  
b = estimated metal content of the ore mined,  
c = estimated metal recovery in the concentrating process,  
d = estimated metal recovery in the smelting and refining processes, and  
e = estimated quantity of tin ore mined in tons.

b. Communist China.

The estimates of tin ore mined in Communist China were obtained by using the formula described in a, above. The total metal recovered in processing, however, was prorated between the Ko-chiu area and other areas on an 80 to 20 basis, and the resultant figures were added to obtain a total figure.

The following percentages were used to calculate the quantity of tin ore mined in the Ko-chiu area:

Average tin content of ore mined = 2 percent.\*  
Average metal recovery in concentrating\*\* = 60 percent.\*\*\*  
Average metal recovery in smelting  
and refining = 90 percent.\*\*\*\*

The following percentages were used to calculate the quantity of tin ore mined in Communist China outside of the Ko-chiu area:

Average tin content of ore mined = 1 percent (assumed).  
Average metal recovery in concentrating = 43 percent. †  
Average metal recovery in smelting  
and refining = 85 percent. ††

\* See p. 11, above.

\*\* For 1955 an average recovery of 70 percent was used (see p. , above).

\*\*\* See p. 12, above.

\*\*\*\* See p. 13, above.

† See p. 13, above.

†† See p. 14, above.

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c. East Germany.

The following percentages were used to calculate the quantity of tin ore mined in East Germany:

Average tin content of ore mined = 0.4 percent.\*

Average metal recovery in concentrating = 50 percent.\*

Average metal recovery in smelting and refining = 87 percent. 220/

2. Regional Distribution in the USSR.

a. Dal'stroy.

The estimate of the total production of tin in Dal'stroy in 1955 is the reported planned production figure. 221/ The division of the estimate for Dal'stroy between Economic Regions XI and XII was based on the following data:

(1) With the exception of the Yana Mining Industry Directorate (at Ege-Khaya), all of the tin-producing directorates of Dal'stroy are in Region XII.

(2) The reported production of the major tin-mining directorates of Dal'stroy in Region XII is as follows:

	<u>Metric Tons</u>
Chaun-Chukotka Mining Industry Directorate (at Pevek)	820 <u>222/</u>
Omsukchan Mining Industry Directorate (at Omsukchan)	420 <u>223/</u>
Chukotka Construction Directorate (at Iul'tin)	220 <u>224/</u>
Total	<u>1,460</u>

\* See p. 16, above.

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(3) Thus, of a total estimated production of 2,080 tons of tin-in-concentrates estimated to have been produced in Dal'stroy in 1955, 1,460 tons can be assigned to 3 directorates in Region XII, leaving a balance of 620 tons unaccounted for.

(4) Because the Yana Mining Industry Directorate in Region XI has been reported as one of the major tin producers in the Dal'stroy area, 225/ two-thirds of the 620 tons are assigned to this directorate.

b. Khingan Area.

The estimates of the quantities of tin produced in the Khingan area are derived as follows:

(1) [ ]

[ ] The government encourages the production of concentrates by individual prospectors.

(2) The production in the Khingan area in 1955 was reported to have been 76.3 percent greater than in 1950, 228/ which is an average annual increase of about 12 percent.

(3) The production in the Khingan area in 1950 also is assumed to have been about 12 percent greater than the estimated production in 1949. The estimates of production for 1950-55 were obtained from this average annual increase of 12 percent.

c. Kazakhstan and Central Asia.

The estimate of production of tin-in-concentrates in Kazakhstan and Central Asia in 1955 was based on the following data:

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(1) The production in Kazakhstan and Central Asia in 1949 is estimated to have been approximately 750 tons, consisting of the production of 3 combines, all in Vostochno-Kazakhstanskaya Oblast (150 tons by the Naryn Combine, 229/ 90 tons by Kalbaredmet, 230/ and 20 tons by Ubaredmet 231/), plus 500 tons to cover the production of a number of small mines in Tadzhik SSR and Kirgiz SSR and that of individual prospectors and geological prospecting organizations.

(2) The tin deposits of Kazakhstan and Central Asia consist of low-grade ores, mainly in pegmatites. 232/ Because intensive exploitation of deposits of this type generally has not been economical in other areas of the world, it is doubtful that production from such deposits in Kazakhstan and Central Asia has been increased appreciably, if at all, during 1950-55.

d. Chitinskaya Oblast and the Tetyukhe-Kavalerovo Area.

A combined estimate of production in the Chitinskaya Oblast and the Tetyukhe-Kavalerovo area was obtained by subtracting the total assigned production (Dal'stroy, Khingan, and Kazakhstan and Central Asia) from the estimated total Soviet production of tin. The derived estimate for the 2 mining areas of 3,900 tons was prorated between the areas on the basis of the ratio of production between the areas in 1949, a ratio of 41.8 to 58.2.

(1) Chitinskaya Oblast.

The estimate of production in the Chitinskaya Oblast in 1949 consists of the sum of the estimated production of the following combines: 300 tons by Khapcheranga, 233/ 300 tons by East Siberia, 234/ 170 tons by Sherlovaya Gora, 235/ 140 tons by Onon, 236/ and 90 tons by Choibalsan (in Outer Mongolia), 237/ plus 200 tons to cover the production of individual prospectors and geological prospecting organizations.

(2) Tetyukhe-Kavalerovo Area.

The estimate of production in the Tetyukhe-Kavalerovo area in 1949 consists of the sum of the estimated production of the following combines: 1,085 tons by Kavalerovo

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(Enterprise 501 238/); 300 tons by Sinancha (based on planned production of 280 tons in 1947 239/); and 85 tons by the Maritime Combine 240/; plus 200 tons to cover the production of individual prospectors and geological prospecting organizations.

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## APPENDIX C

### GAPS IN INTELLIGENCE

A minor metal such as tin, produced in relatively small tonnages and consumed in small quantities in a host of indirect uses, is a commodity on which there is far less information than there is on the more common materials produced, consumed, and traded by the Sino-Soviet Bloc in greater quantities. The major deficiencies in information are as follows:

#### 1. Production.

The most difficult problem regarding the production of tin is establishing totals for individual countries. For the USSR there has not been reported a single tonnage figure, by either country or combine, with the exception of a monthly estimate given early in 1942 in connection with Lend-Lease negotiations. Since 1947, even percentage figures have not been reported in the USSR, and in the Sixth Five Year Plan, no indication is given of the planned increase in production. For Communist China, all information has been in the form of percentages of increase over a pre-Communist peak production.

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#### 2. Trade.

Trade data on shipments of tin between countries of the Sino-Soviet Bloc are fragmentary, consisting of reports of movements from Communist China to the USSR and of a few references of tin shipments by the USSR and China to the European Satellites. Because of the lack of data on intra-Bloc trade, estimates of available supply of tin in the individual countries of the Bloc cannot be developed.

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More information is available on exports of tin to the Sino-Soviet Bloc by the West. Much of this information consists of officially reported trade statistics. [REDACTED]

### 3. Consumption.

Reports on the quantities of tin consumed in any single pertinent category are not available. Because of the differences in the use pattern of tin metal and the derived end products, analogies to Western experience can be considered only as first approximations.

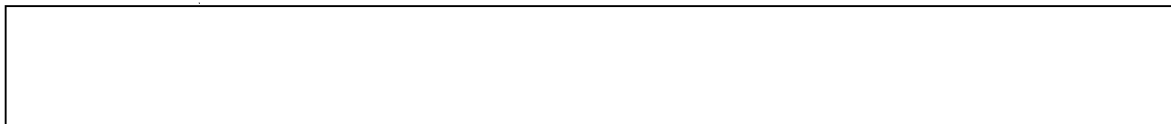
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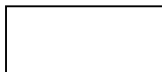


APPENDIX D

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